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REMOTE-ACTUATED EXTERIOR VEHICLE SECURITY LIGHT

BACKGROUND OF THE INVENTION

This invention relates generally to security systems for vehicles and, more particularly, to remotely actuated, personal safety lighting systems. The invention is particularly adapted to incorporation in the exterior mirrors of a vehicle.

Personal security in and around vehicles has become an important concern. In particular, an increasing number of assaults and robberies are committed in parking lots while occupants are entering and exiting vehicles. While remote-operated, keyless entry systems have been incorporated in vehicles in order to unlock the vehicle and illuminate interior lights, such systems merely expedite entry to the vehicle and do not, per se, enhance security around the vehicle. Accordingly, a need exists for a vehicle security system to increase the security for vehicle occupants while entering and exiting the vehicle. Any such system would need to be aesthetically pleasing and not burdensome in use.

SUMMARY OF THE INVENTION

The present invention is intended to provide a personal safety feature for a vehicle in the form of a floodlight adapted to projecting light generally downwardly on an area adjacent a portion of the vehicle in order to create a lighted security zone in the area. Advantageously, the floodlight is preferably positioned in the housing of an exterior mirror having a reflective element also positioned in the housing. According to an aspect of the invention, an actuator is provided for the floodlight including a base unit in the vehicle and a remote transmitter. The base unit

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1 is responsive to a signal from the remote transmitter in
order to actuate the floodlight. This allows the vehicle
operator to actuate the floodlight from a distance in order
to establish the security zone prior to approaching the
5 vehicle.

According to another aspect of the invention, an
actuator for the floodlight includes a lockout device in
order to prevent actuation of the floodlight during
operation of the vehicle. According to yet a further aspect
10 of the invention, a signal light that is adapted to
projecting light generally rearwardly of the vehicle is
included in the exterior mirror housing. An actuator for
the warning light is connected with the stoplight circuit,
turn signal circuit, or both the stoplight and turn signal
15 circuit, of the vehicle in order to actuate the warning
light when either the stoplight or turn signal is being
actuated.

According to yet another aspect of the invention,
the floodlight is adapted to projecting a pattern of light
20 from the housing on an area adjacent a portion of the
vehicle that extends laterally onto the vehicle and
downwardly and rearwardly of the vehicle. In this manner, a
security zone is established from the vehicle door to the
rear of the vehicle. The signal light is adapted to
25 projecting a pattern of light extending laterally away from
the vehicle and rearwardly of the vehicle. In this manner,
the pattern generated by the signal light cannot be
substantially observed by a driver of the vehicle. However,
the pattern generated by the signal light may be observed by
30 a driver of another vehicle passing the vehicle equipped
according to the invention.

1 The floodlight and signal lights may be generated
by a light emitting diode positioned in the housing, a
vacuum fluorescent lamp positioned in the housing, an
incandescent lamp positioned in the housing or a light
5 source in the vehicle and a light pipe between the light
source and the mirror housing.

By providing a lighted security zone adjacent the
vehicle, users can observe suspicious activity around the
vehicle. The pattern of light generated by a security light
10 according to the invention establishes a security zone
around, and even under, the vehicle in the important area
where the users enter and exit the vehicle. The provision
for remote actuation of the security light provides a
deterrent to ward off persons lurking around the protected
15 vehicle while the users are still at a safe distance from
the vehicle. The provision for a lockout circuit ensures
that the security light will not inadvertently be actuated
while the vehicle is in motion. The invention, further,
conveniently combines a signal light that acts in unison
20 with the vehicle's turn signal, brake light, or both, with
the security light in an exterior mirror assembly. The
signal light may be designed to be observed by other
vehicles passing the equipped vehicle but not directly by
the driver of the equipped vehicle.

25 These and other objects, advantages and features
of this invention will become apparent upon review of the
following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Fig. 1 is a perspective view taken from the front
of a mirror assembly (rear of the vehicle) incorporating the
invention;

1 Fig. 2 is a rear view of the mirror assembly in
Fig. 1;

 Fig. 3 is a top view of the mirror assembly in
Fig. 1;

5 Fig. 4 is the same view as Fig. 1 of an
alternative embodiment of the invention;

 Fig. 5 is a block diagram of a control system
according to the invention;

10 Fig. 6 is a block diagram of an alternative
embodiment of a control system according to the invention;

 Fig. 7 is a breakaway perspective view of the
system in Fig. 1 revealing internal components thereof;

 Fig. 8 is a sectional view taken along the lines
VIII-VIII in Fig. 7;

15 Fig. 9 is a sectional view taken along the lines
IX-IX in Fig. 7;

 Fig. 10 is a side elevation of a vehicle
illustrating the security zone light pattern generated by a
security light according to the invention;

20 Fig. 11 is a top plan view of the vehicle and
light pattern in Fig. 10;

 Fig. 12 is a rear elevation of the vehicle and
light pattern in Fig. 10;

25 Fig. 13 is a side elevation of a vehicle
illustrating the light pattern generated by a signal light
useful with the invention;

 Fig. 14 is a top plan view of the vehicle and
light pattern in Fig. 13;

30 Fig. 15 is a rear elevation of the vehicle and
light pattern in Fig. 13;

1 Fig. 16 is the same view as Fig. 7 of a first
alternative light source according to the invention;

 Fig. 17 is the same view as Fig. 7 of a second
alternative light source;

5 Fig. 18 is the same view as Fig. 7 of a third
alternative light source;

 Fig. 19 is the same view as Fig. 7 of a fourth
alternative light source; and

 Fig. 20 is the same view as Fig. 7 of the
10 invention embodied in an alternative mirror structure.

DESCRIPTION OF THE PREFERRED EMBODIMENT

 Referring now specifically to the drawings, and
the illustrative embodiments depicted therein, a vehicle
personal security lighting system 25 includes an exterior
15 mirror assembly 26 having a conventional reflectance element
28, a security light 30, preferably white, or clear, and a
signal light 32, preferably red, incorporated in a housing,
or casing, 34. Casing 34 is connected by a neck 36 to a
stationary panel or sail 38 adapted for incorporation with
20 the forward portion of the vehicle side window assembly, and
which mounts mirror assembly 26 to the door of a vehicle 40
(see Fig. 10). Reflectance element 28 may be any of several
reflectors, such as glass coated on its first or second
surface with a suitable reflective layer or layers, such as
25 those disclosed in United States Patent No. 5,179,471, the
disclosure of which is hereby incorporated by reference
herein, or an electro-optic cell including a liquid crystal,
electrochromic, or electrochemichromic fluid, gel or
solid-state compound for varying the reflectivity of the
30 mirror in response to electrical voltage applied thereacross
as disclosed in United States Patent No. 5,151,824, the

1 disclosure of which is hereby incorporated by reference
herein.

With reference to Figs. 7 and 8, as is
conventional, reflectance element 28 is mounted to a bracket
43 by an actuator 42. Casing 34 is mounted to bracket 43.
5 Actuator 42 provides remote positioning of reflectance
element 28 on two orthogonal axes. Such actuators are well
known in the art and may include a jackscrew-type actuator
42 such as Model No. H16-49-8001 (right-hand mirror) and
10 Model No. H16-49-8051 (left-hand mirror) by Matsuyama of
Kawagoe City, Japan, as illustrated in Fig. 7, or a
planetary-gear actuator 42' such as Model No. 540 (U.S.
Patent No. 4,281,899) sold by Industrie Koot BV (IKU) of
Montfoort, Netherlands, as illustrated in Fig. 20. As is
15 also conventional, the entire casing 34 including actuator
42, 42' is mounted via bracket 43 for breakaway motion with
respect to stationary panel 38 by a breakaway joint assembly
44. Breakaway joint assembly 44 (Fig. 9) includes a
stationary member 46 attached to vehicle 40, a pivoting
20 member 48 to which bracket 43 and casing 34 are attached,
and a wire-way 50 through which a wire cable 52 passes.
Wire cable 52 includes individual wires to supply control
signals to actuator 42, 42', as well as signals to control
the level of reflectivity, if reflective element 28 is of
25 the variable reflectivity type noted above, such as an
electrochromic mirror. Power may also be supplied through
cable 52 for a heater (not shown) as disclosed in United
States Patent No. 5,151,824 in order to evaporate ice and
dew from reflective element 28.

30 With reference to Fig. 5, actuator 42, 42'
receives a first set of reversible voltage signals from a

1 switch 54, in order to bidirectionally pivot in one axis,
and a second set of reversible signals from a switch 56, in
order to bidirectionally pivot in the opposite axis, as is
conventional. Switches 54 and 56 are actuated by a common
5 actuator (not shown) that is linked so that only one of the
switches 54 and 56 may be actuated at a time. In this
manner, actuator 42, 42' may utilize one common conductor
for both switches 54, 56.

Each of the security light 30 and signal light 32
10 includes a light source 60 and reflector 62 behind a lens 64
(Fig. 8). Light source 60, reflector 62 and lens 64 are
designed for security light 30 to project a pattern 66 of
light, such as white light, through a clear, non-filtering
lens, in order to establish a security zone around the
15 vehicle (Figs. 10-12). Pattern 66 extends rearward from
mirror assembly 26. Vertically, pattern 66 contacts the
ground at 68 in the vicinity of entry and exit by the
vehicle occupants (Figs. 10 and 12). Laterally, pattern 66
fans out into contact with the side 70a, 70b of the vehicle.
20 This contact washes the sides of the vehicle to reflect the
light in order to further illuminate the area in order to
establish the security lighting zone (Figs. 11 and 12). In
a preferred embodiment, pattern 66 extends rearwardly from
mirror assembly 26 without projecting any portion of the
25 pattern forwardly of the mirror assembly.

Signal light 32 generates a light pattern 72,
which is directed generally horizontally rearwardly of
vehicle 40 (Figs. 13-15). Pattern 72 is laterally directed
substantially away from side 70a, 70b of vehicle 40 so that
30 the driver of vehicle 40 does not directly intercept pattern
72, although a minor intensity (such as 10%) of the pattern

1 is intercepted by the driver in order to provide awareness
of the actuating of the signal light. Pattern 72 fans
laterally away from side 70a, 70b to an extent that is
parallel the face of reflectance element 28, which is
5 substantially perpendicular to side 70a, 70b (Fig. 14).
Thus, the driver of another vehicle (not shown) passing
vehicle 40 on the left or right side of vehicle 40 will
intercept pattern 72 while the vehicle is behind and beside
vehicle 40. Although, in the illustrated embodiment, lens
10 64 of signal light 32 is substantially planar, lens 64 of
signal light 32 could be made to wrap around the outward
side of casing 34 in order to function as a side marker for
the vehicle as is required in some European countries.

Vehicle mirror assembly security system 25 is
15 actuated by a control system 74 (Fig. 5). Control system 74
includes means for actuating security light 30 including a
remote transmitting device 76 and a stationary receiving
device 78. Transmitting device 76 may be remotely carried
by the vehicle operator and includes switches 80 and 81 in
20 order to actuate the transmitting circuitry to transmit a
signal from antenna 82, which is received by antenna 84 of
receiving device 78. Receiving device 78 is mounted in the
vehicle, such as in the vehicle trunk compartment, and
includes an output 86 in order to operate remote door lock
25 circuit 88, as is conventional. Output 86 is, additionally,
provided as an input 90 of a lockout circuit 92, whose
output 94 is supplied to security lamp 30. Input 90 may
additionally be actuated by a timeout circuit 96, which is
conventionally supplied in a vehicle in order to dim the
30 interior lights, following a slight delay, after the
occurrence of an event, such as the opening and closing of

1 the doors of the vehicle. Signal light 32 is actuated on
line 98 from either a turn indicator circuit 100 or a stop
lamp indicator circuit 102, both of which are conventionally
supplied with vehicle 40.

5 In operation, when the operator actuates switch 80
of transmitting device 76, receiving device 78 produces a
signal on output 86 in order to cause remote door lock
circuit 88 to unlock the doors. Alternatively, actuation of
switch 81 on remote transmitting device 76 causes receiving
10 device 78 to produce a signal on output 86 to cause remote
door lock circuit 88 to lock the vehicle doors. The signal
on output 86 actuates security lamp 30 provided that lockout
circuit 92 does not inhibit the signal. Lockout circuit 92
responds to operation of the vehicle in order to avoid
15 actuation of security lamp 30 when the vehicle is in motion.
Such lockout circuits are conventional and may be responsive
to placing of the vehicle transmission in gear or sensing of
the speed of the vehicle, or the like. Security lamp 30 is
also actuated, in response to interior lighting device
20 timeout circuit 96, whenever the interior lights of the
vehicle are being actuated by timeout circuit 96, provided
that lockout circuit 92 does not inhibit the signal from
security lamp 30. This is provided in order to allow
security lamp 30 to be actuated in response to the entry to,
25 or exit from, vehicle 40 without the operator utilizing
transmitting device 76 to lock or unlock the doors. Signal
lamp 32 is actuated in response to turn indicator circuit
100 whenever the operator moves the indicator stick in the
direction of that particular signal lamp 32. Signal lamp 32
30 may additionally be actuated from stop lamp circuit 102 in
response to the driver actuating the vehicle's brakes.

1 In the embodiment illustrated in Figs. 1 and 5,
lens 64 of signal lamp 32 is adapted to filter the light
provided from lamp 32 so as to be red and is provided for
vehicles 40 in which the stop lamps and rear turn indicator
5 lamps are, likewise, red. Because signal lamp 32 shines
red, pattern 72 is restricted from extending forward of the
vehicle. This is in order to comply with regulations
prohibiting red lights from causing confusion with emergency
vehicles by shining forward of the vehicle.

10 For vehicles having red stoplights and amber turn
indicators in the rear, a vehicle mirror security assembly
25' includes an exterior mirror assembly 26' and a control
system 74' (Figs. 4 and 6). Exterior mirror assembly 26'
includes a security light 30', preferably white or clear,
15 and a pair of signal lights 32a' and 32b'. Signal light
32a' is amber and is actuated directly from turn indicator
circuit 100'. This amber color can be provided either by an
amber light bulb or source, or a filtering lens providing an
amber color. Signal light 32b' is red and is actuated
20 directly from stop lamp circuit 102'. Each of the light
patterns generated by signal lights 32a' and 32b'
substantially correspond with light pattern 72. The light
pattern generated by security light 30' is substantially
equivalent to pattern 66. With the exception that turn
25 signal indicator circuit 100' actuates signal light 32a' and
stop lamp circuit 102' actuates signal light 32b', control
system 74' operates substantially identically with control
circuit 74.

30 In the illustrated embodiment, light source 60,
for both security light 30 and signal light 32, may be
supplied as a conventional incandescent or halogen lamp 60a

1 (Fig. 7). Alternatively, a conventional incandescent fuse
lamp 60b may be used (Fig. 16). Alternatively, a vacuum
fluorescent lamp 60c, which is available in various colors,
may be used (Fig. 17). Alternatively, a light emitting
5 diode 60d may be used (Fig. 18). As yet a further
alternative, a fiber optic bundle 104 forming a light pipe
may be positioned to discharge light behind lens 64. Fiber
optic bundle 104 passes through breakaway joint 44 in
wire-way 50 in order to transmit light from a source (not
10 shown) within vehicle 40. By way of example, lens 64 may be
supplied as a segmented lens, a prismatic lens, or a Fresnel
lens in order to generate light patterns 66 and 72. Bracket
43 and breakaway joint 44 are marketed by Donnelly
Corporation, the present assignee, of Holland, Michigan.
15 The remote actuator composed of remote transmitting device
76 and stationary receiving device 78 may be radio frequency
coupled, as is conventional. Alternatively, they may be
infrared coupled as illustrated in United States Patent No.
4,258,352.

20 Although the invention is illustrated in a mirror
assembly utilizing an automatic remote actuator, it may also
be applied to manual remote actuators and handset actuators.
As previously set forth, reflectance element 28 may be
conventional or may be supplied as an electrochromic
25 self-dimming mirror. Although the invention is illustrated
with breakaway joint 44, the invention may also be applied
to mirrors that are rigidly mounted to the vehicle.

Changes and modifications in the specifically
described embodiments can be carried out without departing
30 from the principles of the invention, which is intended to
be limited only by the scope of the appended claims, as

1 interpreted according to the principles of patent law
including the Doctrine of Equivalents.